# Appendix G
# Consistency with Other Missouri Ecosystem initiatives

SUMMARY OF ECOSYSTEM MANAGEMENT ELEMENTS

INITIATED BY MARK TWAIN NATIONAL FOREST

OR

THAT THE MARK TWAIN NATIONAL FOREST HAS PARTICIPATED IN/SPONSORED/SUPPORTED

February 17, 1997

Mark Twain National Forest Land & Resource Management Plan, 1986 (FLMP):

Allocates land to emphasize different resources according to the capabilities of the land as expressed by Land Type Association.

Provides protection for elements of biodiversity such as special/uniqueareas (caves, springs, pages IV-17/18/19); wilderness (7 designated wilderness totalling 63,200 acres, pages IV-139 to IV-163); designated natural areas or other areas of special scientific, biological, historical, geological, scenic, recreational, and educational significance (pages IV-193 to IV-215);

Provides for a diversity of habitat conditions and successional stages tomeet the needs of native and desired non-native Missouri wildlife species (pages IV-49 to IV-65).

Soil Survey, 1960's - 1986:

An order 2 survey completed for all the forest in 1986. Most mapping done by Forest Service soil scientists. Some mapped by SCS and DNR soil scientists under cooperative agreement. Cooperative Soil Survey nowongoing and scheduled for completion by 2000. This will update existing information. Soil survey used to help develop Terrestrial Ecological Classification System and is used to evaluate potential effects of management in Environmental assessments.

Terrestrial Ecological Classification System, 1981:

Developed to stratify & classify lands within the National Forest System to provide land capability information. Combines soil, landtype & vegetation information to delineate a particular level of ecological unit.

FLMP uses Land Type Associations as the basis for land allocation and uses Ecological Land Types (ELT's) to define appropriate/inappropriate locations for various resource activities.

Aquatic Ecological Classification System, 1982:

Provides a definition of aquatic ecosystems, including subterranean, for National Forest System lands. Defines type of ecosystem, water flow, gaining/losing, typical fish species composition, and interpretation of capability to support recreation uses.

Used in development of standards & guides for Forest Plan. Project planning uses Aquatic ECS to identify area subject to floodplain/wetland executive orders, riparian areas, and other wetlands subject to Forest Plan standards & guides to protect wetlands.

Missouri Biodiversity Task Force, 1992:

Initiated by Mark Twain National Forest and Missouri Department of Conservation

Task Force composed of scientists recognized as expert in their field, in the fields of natural communities ecology, ichthyology, genetics, animal ecology, Missouri's geographical, climatic, and vegetative history.

Published report "The Biodiversity of Missouri, Definition, Status, and Recommendations for its Conservation, Report of the Biodiversity Task Force, March 1992".

Report defines biodiversity, discusses factors that create, maintain, or decrease biodiversity and describes present biodiversity of Missouri. Goals for conservation of biological diversity in Missouri are identified.

Report is available and being used at each district office of the Mark Twain National Forest.

Seven Interagency Working Groups (ECS, GIS, Genetic Biodiversity, Biodiversity Eduation, Goals, Research and Sensitive Species) have been established.

Missouri Neotropical Migrant Bird Working Group, 1991 ongoing:

Participants include:
- USDA Forest Service, Mark Twain National Forest
- USDA Forest Service, North Central Forest Experiment station
- US Fish & Wildlife Service
- Missouri Department of Conservation
- University of Missouri-Columbia, School of Natural Resources

Objectives:
- Determine species status in Missouri & range-wide
- Determine management needs of species
- Recommend appropriate management practices to agencies
- Identify species information & research needs
- Coordinate with Regional & National Strategy Teams

Accomplished: Identify species of concern for Missouri (6 forest species - ovenbird, wood thrush, cerulean warbler, Kentucky warbler, worm-eating warbler, Swainson's warbler; 5 grassland species - grasshopper sparrow, dickcissel, bobolink, Bachman's sparrow, Henslow's sparrow)

Missouri Fish & Wildlife Information System, 1986 ongoing:

Database managed by MDC which contains information on over 700 species of Missouri vertebrate wildlife. The Mark Twain uses this to obtain reports on status & distribution of species, and to check habitat requirements and other life history information for use in environmental analyses.

GAP Analysis:

1993 ongoing - Initiated by US Fish & Wildlife Service in cooperation with MDC and USFS. Objective is the identification and classification of biodiversity for the state of Missouri. This program is being coordinated with MDC's Coordinated Resource Management plans.

MORap:

1994 proposed statewide multi-agency Geographic Information System. Coordinate information needed by all agencies into one system to avoid duplication of effort and expenditures.

**Research efforts focusing on Biodiversity/Ecosystem management:**

MOFEP, Missouri Forest Ecosystem Project:

MDC long term project initiated in 1991 with objective of examining the effects of forest management on various components of the Ozark forest ecosystem - specifically the effects of even- and uneven-aged management on herpetofauna, small mammals, neotropical migrant birds, litter invertebrates, oak-leaf chewing insects, fungi, tree genetic diversity, tree species composition, herbaceous vegetation, carbon cycles, and soft & hard mast.

North Central Forest Experiment Station:

For approximately the past 6-10 years, NCFES has been directing their studies to issues which have a direct bearing on management of forest ecosystems. Well over 50 studies have beencontinued, initiated and/or completed on characteristics of oaks and oak forests; methods and effects of various management techniques in oak and pine forests; effects of disturbances in various community types and soil & water resources; status, distribution, and effects of management on bird species; habitat selection of various bird species; effects of cowbird parasistism and edges on nesting sucess of forest birds; and other miscellaneous topics.

A list of studies provided by NCFES is attached to this paper. Some of those with direct application to the Mark Twain National Forest include:

- ✓ Breeding populations of forest birds in Missouri Ozark forests with and without clearcutting (Completed)
- ✓ Simulated responses of a forest interior bird population to forest management practices (Ongoing)
- ✓ Movements and habitat preferences of brown-headed cowbirds in midwest landscapes (Ongoing)
- ✓ Monitoring forest bird population trends in central states National Forests (Ongoing)
- ✓ Ordination & classification of Ozark savanna vegetation (ongoing)
- ✓ Uneven-age management on the Mark Twain National Forest (long-term)
- ✓ Compostion & structure of old growth hardwood forest in the midwest (near completion)
- ✓ Treefall gap dynamics in Missouri old-growth forests (ongoing)
- ✓ Effects of disturbance on herbaceous vegetation in MO savannas and glades (ongoing)
- ✓ Habitat monitoring in harvested and nonharvested oak-hickory forests in MO (completed)
- ✓ Cowbird parasitism defense and nesting success of forest-edge migrants (completed)
- ✓ Effects of edges on avian nesting success and mammalian communities (completed)
- ✓ Fragementation of Central Hardwood ecosystems:impacts on bird communities in Missouri (ongoing)
- ✓ Forest productivity affected by soil & water properties related to Missouri landscapes (near completion)

Natural Heritage Inventory/Natural Features Inventory:

Initiated in 1985 to locate, describe, classify, evaluate and rank the high quality elements of Missouri's natural heritage. Elements considered in the inventory include natural communities, rare & endangered species sites and other special interest features. Inventory of all National Forest System lands completed by 1995. Each district uses the appropriate inventory report when preparing Biological Evaluations and Environmental Assessments.

Cave Inventory/Evaluation:

1978-1982 & Treva Gardner, MDC conducted an inventory to collect and compile data and use the data to develop recommendations for a responsible cave management program on the Mark Twain National Forest. 226 caves successfully inventoried. Information on cave resources, hazards & previous public use documented. Classification system developed as management guideline. This report was used to help develop standards & guides for Mark Twain Forest Plan. In 1994 there are 355 caves listed for the Mark Twain National Forest with about 5-10 "new" caves discovered each year.

Cave Mapping/Inventory:

The Cave Research Foundation (CRF) signed a Challenge Cost Share Agreement in 1990 to map caves and inventory cave fauna on the Mark Twain National Forest. Since then, CRF has completed mapping of and baseline biological inventory of over 100 caves. Survey work is ongoing in 1997.

Spring Recharge/Dye Tracing:

Ozark Underground Laboratory contracted with Mark Twain National Forest to conduct limited dye traces to determine recharge areas for 3 caves on Eleven Point District (containing endangered bats potentially affected by mineral exploration/development) and various streams/springs on Willow Springs District. Tentative boundaries delineated 1992. Further work on forest is needed with the objective of eventually using computer modelling to show subsurface topography and dry & wet passages in relation to surface topography.

USGS water quality/flow monitoring:

1990 ongoing Collect baseline information on water levels with the objective of drawing potentiometric maps of the area. Collect information on cations, anions, nutrients & trace metal concentrations in water from 13 spring & stream locations and from 50 wells in Shannon & Oregon Counties. Work continuing 1997 to explain the major factors that affect observed water quality conditions and trends.

USGS National Water Quality Assessment Program:

Ongoing. Objective is to identify, describe, and explain the major factors that affect observed water quality conditions and trends. Recurring local and regional problems related to managing and protecting water quality in the Ozark Plateau study unit will be addressed. Paddy Creek on the Houston District is a surface water monitoring site for the study. Subsurface monitoring sites will be established in the near future.

Stream geomorphology & effects on fish habitat:

Objectives include documentation of past geomorphic change; measurement of current rates of geomorphic change; development of a monitoring scheme to measure future change; analysis of this geomorphic change in relation to fish habitat; and based on this analysis, develop guidelines for management of aquatic & riparian ecosystems. Work being done on Spring Creek & Mill Creek on Houston/Rolla District.

Air Quality monitoring:

1991 ongoing: Southwest Missouri State University, a private landowner and Mark Twain National Forest cooperate to monitor visibility over Hercules Glade Wilderness, the forest's only Class 1 Airshed to establish visibility baseline for the Wilderness. Weather conditions are taken by a solar-powered weather station to correlate with visibility data.

Lichen study to determine if lichens can be used to monitor air quality.

Soil monitoring:

Procedure developed to predict potential soil loss in tons per acre per year for individual management practices, based on factors of rainfall, soil erodibility, slope-length, slope-steepness & cover management. This process is being used as part of site-specific environmental assessments to develop practices to minimize erosion potential from soil disturbance.

Fire History:

Rich Guyette & Bruce Cutter for University of Missouri collected data from old trees and stumps to determine fire intervals and intensity for several areas of the forest (Ava/Cassville/Willow Springs, Houston/Rolla).

Prescribed burn monitoring:

Several districts have set up monitoring sites to evaluate changes to plants, soil, and animals as a result of prescribed burning. Also Willow Springs looking at control of shade-tolerant competitors of oak/pine regeneration.

The Nature Conservancy do pre- and post-burn surveys of Butler Hollow Glades State Natural Area (Cassville District) and Grasshopper Hollow State Natural Area (Salem District).

Glade ecosystems:

1993 Paul Martin & Garry Houf evaluation of processes which created glade ecosystems of southwest Missouri, factors which have caused woody invasion of the glades, and options for management to restore open condition.

Consequences of glade management:

1980 Nutrient cycling approach and paired watersheds were used to determine effects of cedar harvesting, prescribed burning & grazing on glade hydrology and nutrient fluxes; to determine effects of these management practices on soil status and vegetative productivity and to compare the estimated rates of soil formation and erosion under various management practices. Conducted by the USDA Forest Service & the University of Missouri.

Flatwoods restoration study:

The Nature Conservancy & Forest Service looking at pre-settlement vegetation data and evaluating methods/techniques & results of flatwoods restoration project on Houston/Rolla District.

Use of Oak Savannas by Songbirds in MO:

ongoing - MDC study has several sites on Mark Twain National Forest.

Old Growth Composition & Structure:

NCFES 1991- 1994 Define the current location & vegetative condition of midwest old growth ecosystems & describe the extent of future old growth forests that will develop from implementation of existing public land management plans.

Oak mortality:

1980 - 1983 Low-level infrared color photography was used to locate areas of oak mortality. Northeastern Area State & Private Forestry, Pest Management Group, did the aerial survey who observed an mapped areas of probable mortality. The report of this group highlighted weather conditions thought to play a major role in causing the mortality.

1982 - 1991 study to document patterns of mortality and species changes in a stand where scarlet oak decline is present and no salvage cutting has taken place. Plots established and checked yearly to determine progression of mortality and regeneration.

Vegetation Change Analysis:

1990 - 1992 Determined vegetative changes between 1986 and 1991. Measured by classifying 1986 & 1991 LANDSAT imagery reports. Vegetation change maps for different scales can be made using this information.

Evaluation of Effects of Timber/Wildlife Management on Non-game Birds:

near completion MDC study-data collected and is being analyzed.

TE Botanical Surveys:

Since 1991, the Mark Twain has contracted 65,137 acres of botanical survey to locate populations of state & federally listed plant species. New locations are entered into the Missouri Natural Features/Heritage Inventory database.

Wilderness Vegetation:

1992 ongoing: Baseline inventory of vegetation at the Forest's seven Wildernesses. 0.1 acre plots are distributed across all ELT's. Five Wildernesses completed, Hercules Wilderness underway in 1994.

Rhododendron/Azaleas:

Study of the genetic and site differences of azaleas/rhododendron in the midwest done by Mark Widrlechner.

Running buffalo clover:

Since 1991, a temporary botanist has been working to establish populations of this Federally Endangered plant on the MarkTwain National Forest and conduct research into the biology & management of this species. Work suspended in 1996 due to lack of funds.

Buffalo clover:

Working to locate, restore & establish populations of this Missouri Status Undetermined species of concern on the Mark Twain National Forest to enhance species richness in appropriate habitat.

Animal Population Surveys & Research:

NOTE: Most surveys initiated by MDC and/or North Central Forest Experiment Station. Mark Twain employees have assisted and/or participated in most, if not all, of these surveys.

Beetles:

1994 ongoing - Doug Le Doux, Columbia, MO given permission to inventory clerids & melyrids in Mark Twain National Forest State Natural Areas.

Rock bass & crayfish:

1991 ongoing - MDC survey to determinepopulation structure of rock bass & crayfish in Eleven Point River.

Fish contaminants:

MDC & USFSW determine levels of chlordane, heavy metals, chlorinated hydrocarbons & other contaminants in fish tissue of fish in the Eleven Point River.

Collared lizard:

Templeton, Washington University 1980's - DNA mapping was done to determine genetic differences between lizard populations on different glades. As glades close in, it appears that populations of lizards become isolated from each other.

Ruffed Grouse:

early 1980's drumming counts run to determine success of release efforts.

Swainson's warbler:

1992 - 1993 search of cane along rivers to determine locations and breeding success.

Bachman's sparrow:

Rochelle Renken, habitat needs assessment and evaluation of why sparrows are found on some areas, but not others.

Breeding birds:

Beginning 1991 point counts set up in both managed and unmanaged forest on all districts of the Mark Twain National Forest. Objective is to run counts annually and get long-term data on species occurrence, differences due to management, and eventually breeding success.

Turkey mortality:

MDC 10 year study initiated 1989 to determine extent & causes of turkey mortality in Missouri Ozarks.

Accipiters:

Nest searches made late 1980's.

Black Bear:

1991 - 1996 baited routes run to determine numbers & distribution of bear population in Missouri.

Swamp rabbit:

1990 ongoing: A search of suitable habitat and requests for swamp rabbit sightings/reports from public to determine locations and numbers.

Squirrels:

Early 1980's: Survey to determine relative squirrel populations on the forest.

Furbearers:

MDC conducts annual furbearer roadside survey to determine population trends.

**OTHER:**

These have not been funded by the Forest Service, nor have FS personnel been involved. However, they have application to management of the Mark Twain National Forest and have been used, are being used, or will be used in the future.

Riparian Ecosystem Assessment and Management (REAM):

MDC lead agency with support by EPA, DNR, SCS, TNC. Data being collected in northern Missouri watersheds, but will impact programs statewide. A study of soils & geomorphology was done to document their relationship to vegetation. Nutrient cycling and water quality was reviewed from a systems ecology standpoint.

Big Springs Ecosystem Study:

Ozark National Scenic Riverways studying spring morphology and functions.

Aquatic Community Classification System for Missouri - Pflieger, 1989.

Geographic Natural Features System for Missouri - Hebrank, 1983.

Terrestrial Natural Communities of Missouri - Nelson, 1985.